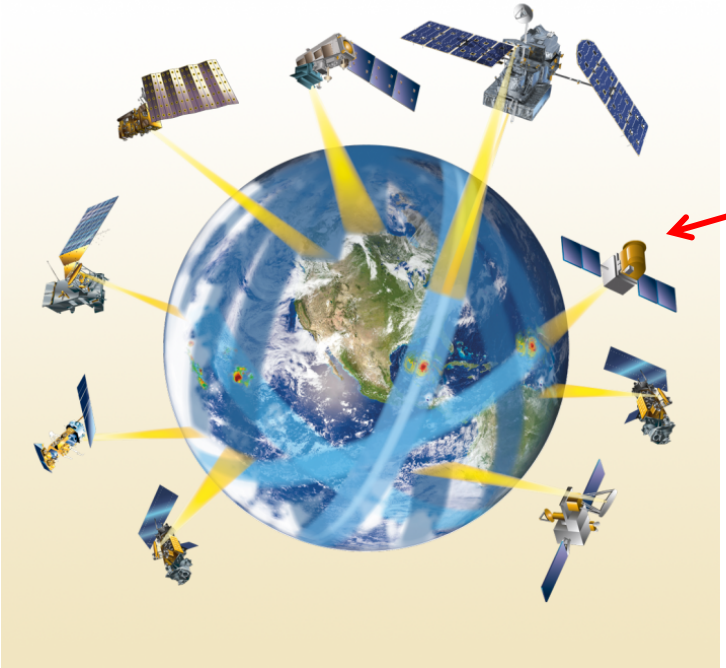
Status of the Megha-Tropiques mission and precipitation activities



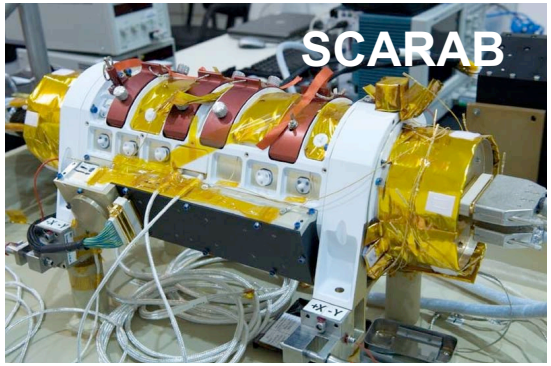
Philippe Chambon, Rémy Roca
and the French Megha-Tropiques Science Team

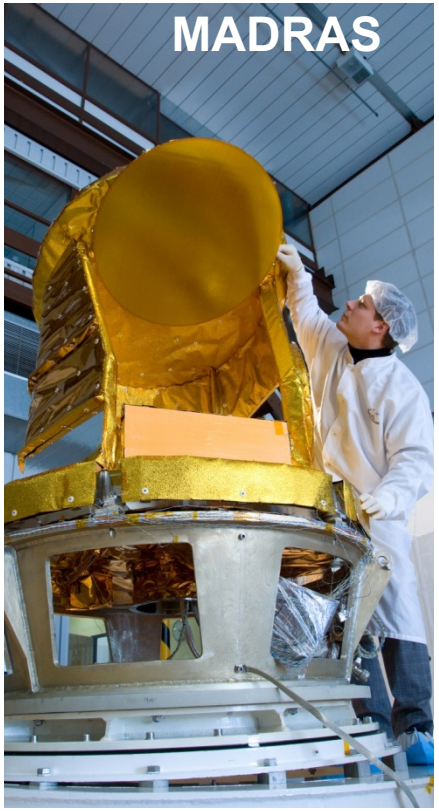
Outline of the presentation

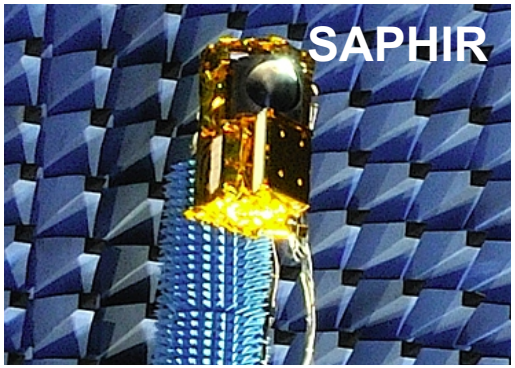
1. **Status of the mission**
2. Current activities on precipitation estimation
3. Data assimilation activities in rainy conditions
4. A renewed scientific project for the next 4 years
5. Summary

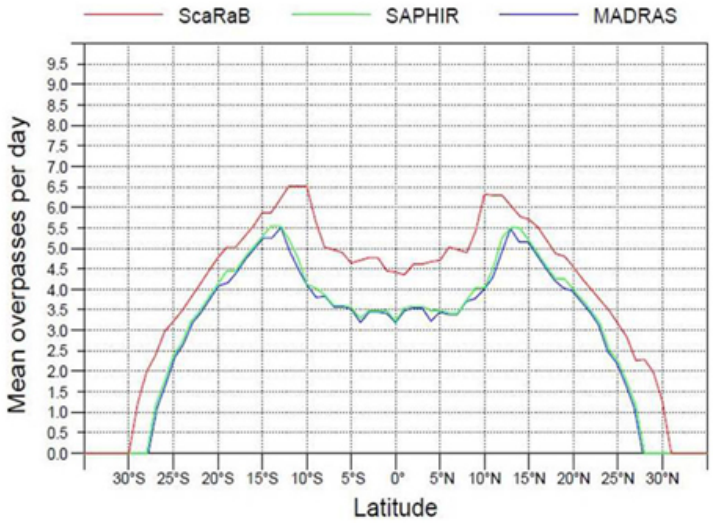
1. Status of the mission

- Indo-French Mission built by ISRO and CNES launched in October 2011
- Dedicated to the monitoring of the water and energy cycle in the tropics
- Orbit with 20° inclination on the equator
- Nominal life: 3 years + 2 years extension up to end 2016



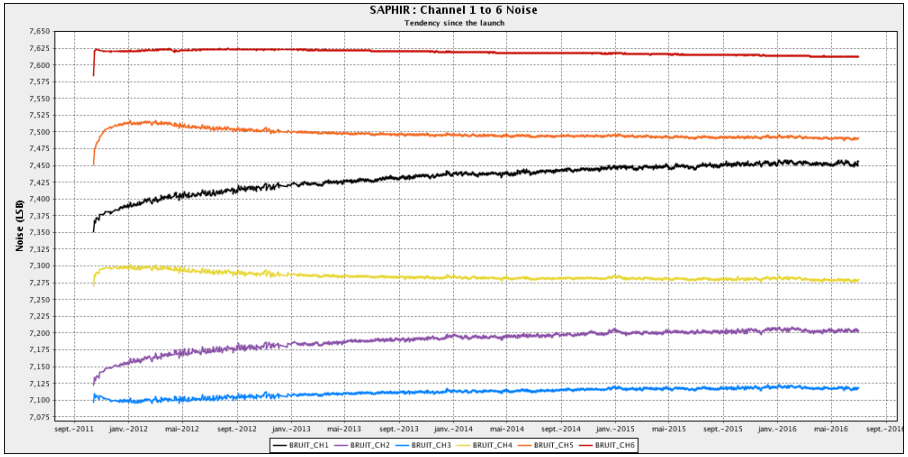


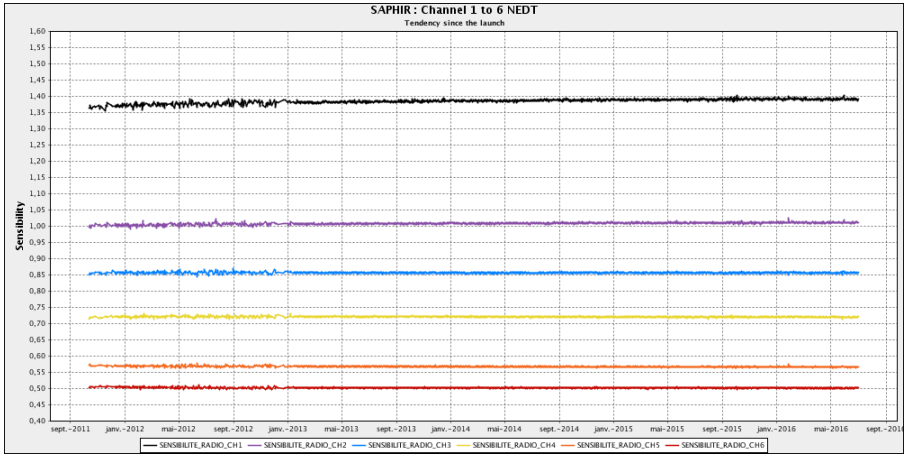




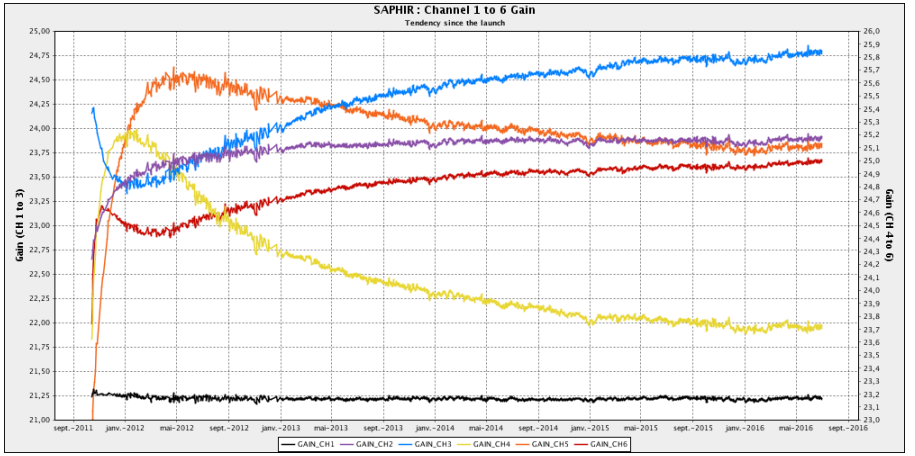
(Courtesy CNES)

1. Status of the mission





- SAPHIR has been in operations for 5 years
- No performance drift has been detected so far
- More than 150 monitored parameters on the instrument



⇒ SAPHIR, SCARAB and the platform being in good health, further extension 2017-2020 was requested by the PI to CNES in December 2015

⇒ A renewed scientific project was proposed to CNES and recently accepted (see in a few slides)

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2. Current activities on precipitation estimation

- The **TAPEER-BRAIN algorithm** combines microwave and infrared observations to provide precipitation estimates and their associated error bars at the 1°/1-day accumulated scale, over land and ocean

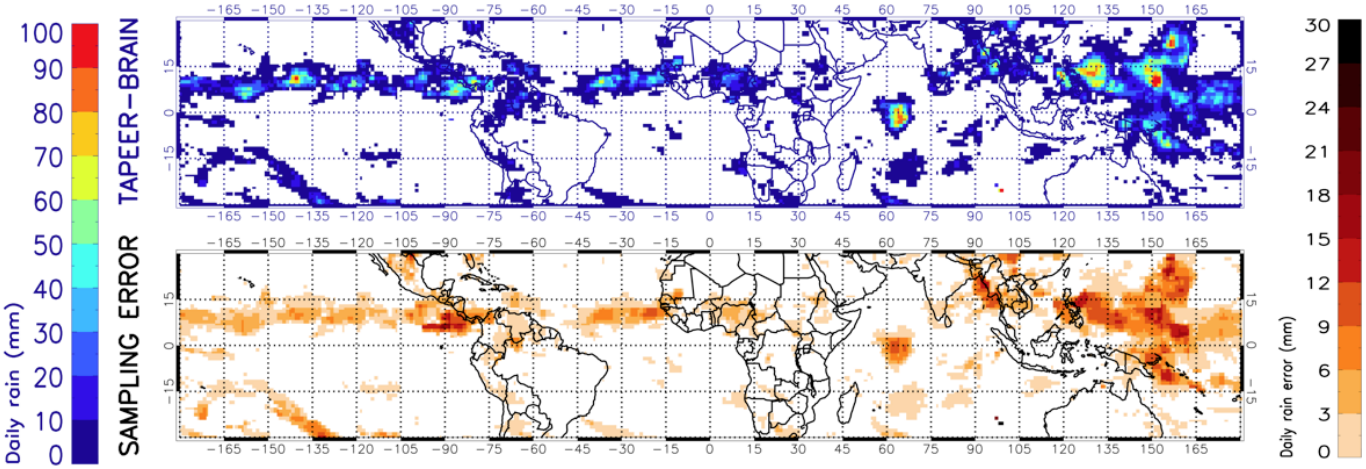
Accumulated Rainfall (in mm)

=

R_{cond} (in mm/day) x Frac (%)

STEP1 : BRAIN estimation on TMI, AMSR2, SSMI F15, SSMIS F16, F17, F18
5°x5-day training volume optimized for estimating the mean with as many sample as possible

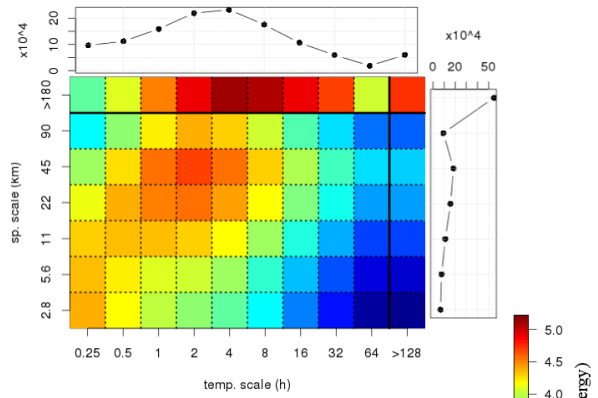
STEP2 : BRAIN detection on TMI, AMSR2, SSMI F15, SSMIS F16, F17, F18
"Hong" like detection on SAPHIR
3°x1-day training volume optimized for representativeness of BT IR thresholds with daily updates



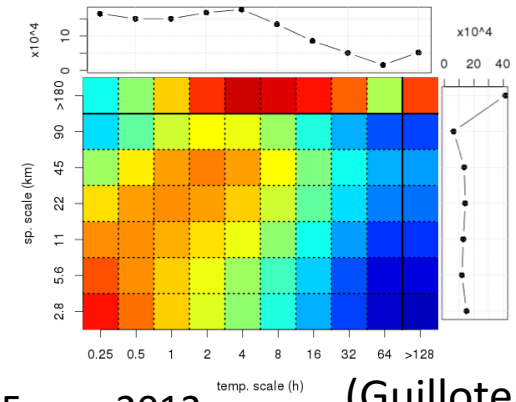
2. Current activities on precipitation estimation

- Validation studies performed at fine scale with ground radar data over West Africa
- Comparisons of TAPEER rain/no-rain masks at sub-daily and sub-degree scale

TAPEER



GROUND RADAR

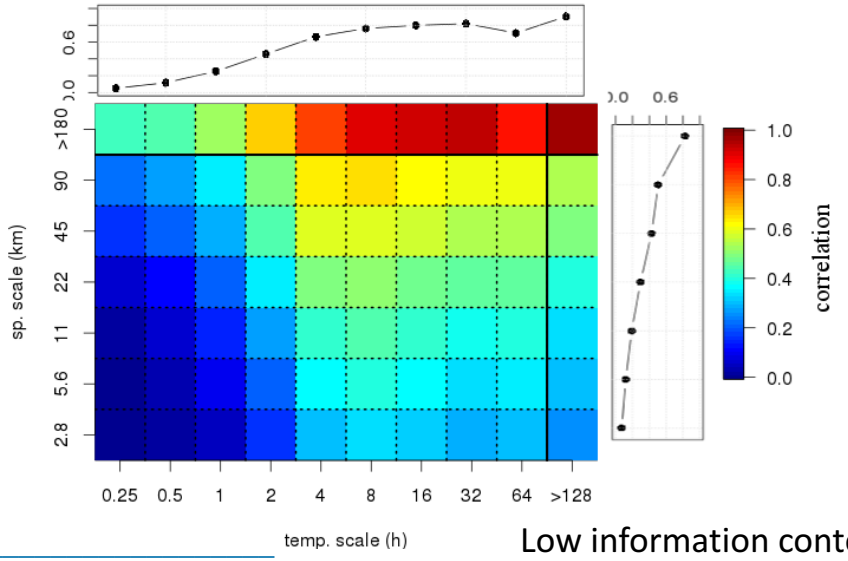


Xport radar, Burkina Fasso, 2012

(Guilloteau et al., 2016)

⇒ In the wavelet space to identify the scales for which the precipitation fraction (fraction of space and time that is rainy) derived from satellite observations is consistent with the reference.

CORRELATION OF WAVELET COEFS



Low information content
When scale < 4h
< 20km

Outline of the presentation

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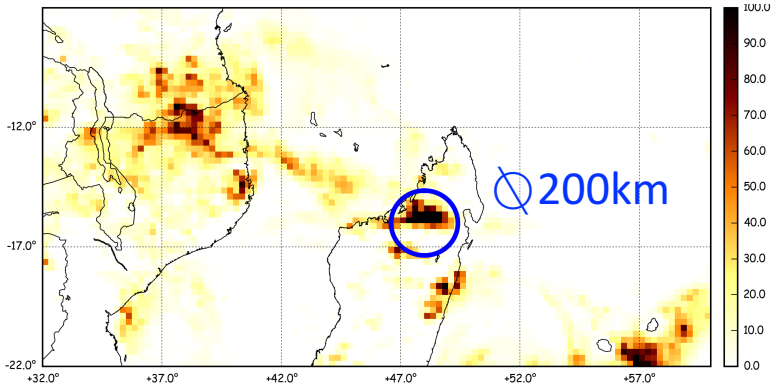
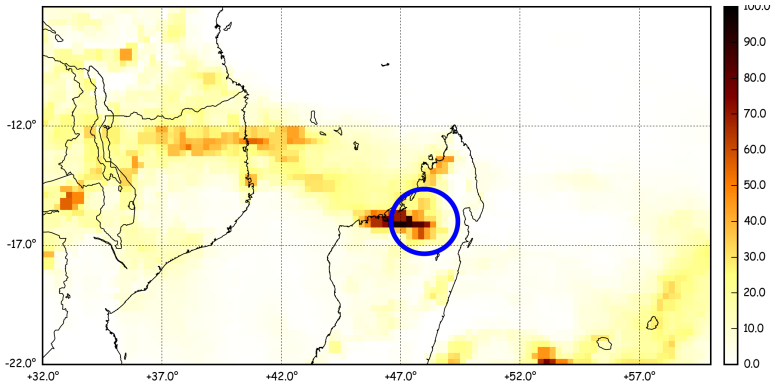
3. Data assimilation activities in rainy conditions

- SAPHIR data are now assimilated routinely in non-scattering conditions at Météo-France, JMA, Met-Office, NCMRWF, SAC Ahmedabad (experiments are ongoing at JCSDA/NOAA)

TRMM 3B42 V7, 24h accumulation, 18 Jan. 2015



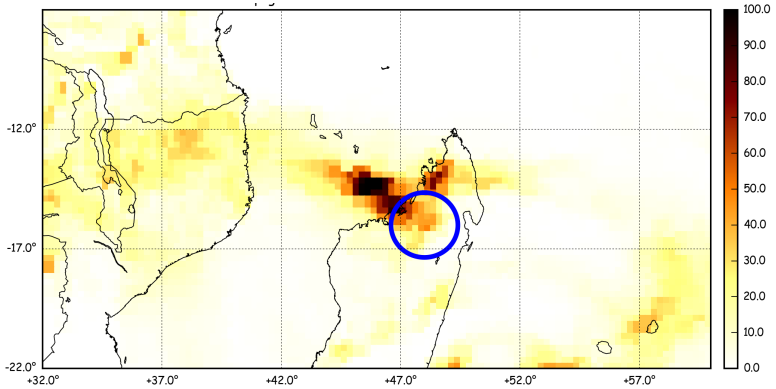
+36h forecast (-12h spin up), CTRL+ SAPHIR assimilated



- a Météo-France/ECMWF collaboration will lead to SAPHIR "all-sky" assimilation by the end of 2016 in the IFS

⇒ improved ECMWF rainfall forecasts

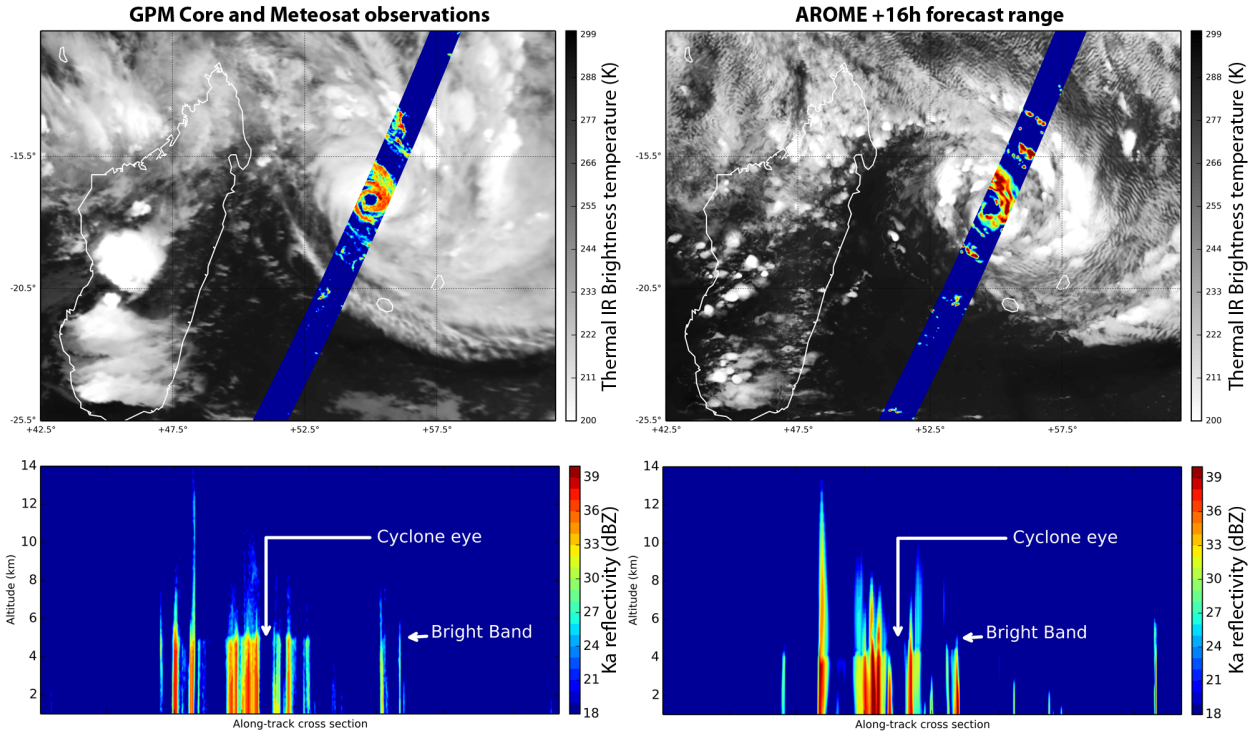
+36h forecast (-12h spin up), CTRL experiment



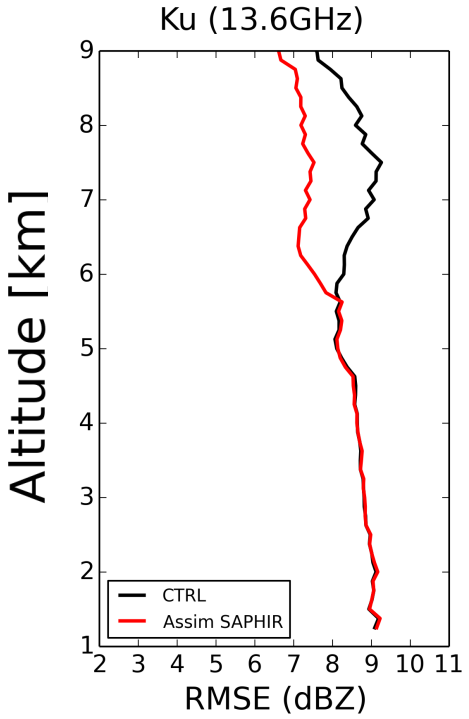
3. Data assimilation activities in rainy conditions

- Tests are ongoing at Météo-France to assimilation SAPHIR in “all-sky conditions” both on the global model ARPEGE and the non-hydrostatic LAM model AROME
- Data assimilation results are validated against DPR reflectivities using Goddard SDSU (Collaboration with Sara Q. Zhang and Ziad Haddad)

Example of Tropical Cyclone Bansi, Jan. 2015



=> Positive impact of SAPHIR assimilation on hydrometeors forecasts, using DPR as ref.



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4. A renewed scientific project for the next 4 years

- A renewed scientific project was submitted to CNES by the "GDR Megha-Tropiques" as part of the CNES extension review process for the 2017-2020 period

- The GDR Megha-Tropiques is a CNRS collaboration tool for coordinating the national scientific activities related to the mission
  - Several labs involved: CNRM, GET, IPSL, ICARE, LA, LAMP, LATMOS,LEGOS, LTHE, LOA, LOCEAN, LMD,…
  - Several institutions: INSU, IRD,CNES Météo-France Universités
  - A community of ~50 people involved

Tropical meteorology and Data assimilation
Resp JP Duvel and P Chambon

Hydrometeorology
Resp M Gosset

Convective Systems life cycle
Resp D Bouniol

⇒The renewed project was accepted together with MT extension for the next 4 years

⇒2.5M€ /year in Human Resources from the institutions involved + 250k€/year support from CNES

4. A renewed scientific project for the next 4 years

Tropical meteorology and data assimilation

Resp JP Duvel and P Chambon

- Identifying the critical processes which drive Tropical variability at various scales (diurnal to intra-seasonal variability)
- Improving NWP analysis and forecasts to be used for the process studies, by assimilating cloudy and rainy MW radiances

=> Use of SAPHIR, GMI, etc for assim. and DPR for validation

4. A renewed scientific project for the next 4 years

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Resp M Gosset

- Analyzing the hydrological impact of Tropical rainfall variability, in particular from intense/extreme events

=> Development of a new version of the TAPEER algorithm using GPROF rain rates to benefit from the dev. on GMI, SAPHIR

4. A renewed scientific project for the next 4 years

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Convective Systems life cycle

Resp D Bouniol

- Analyzing the processes involved in the MCS life cycle by documenting the evolution of their macro/microphysical properties

=> Data mining approach using geostationary data (TOOCAN MCS tracking algorithm) and a composite methodology of multi-sensor information (CPR, DPR, SCARAB, SAPHIR, IASI, …)

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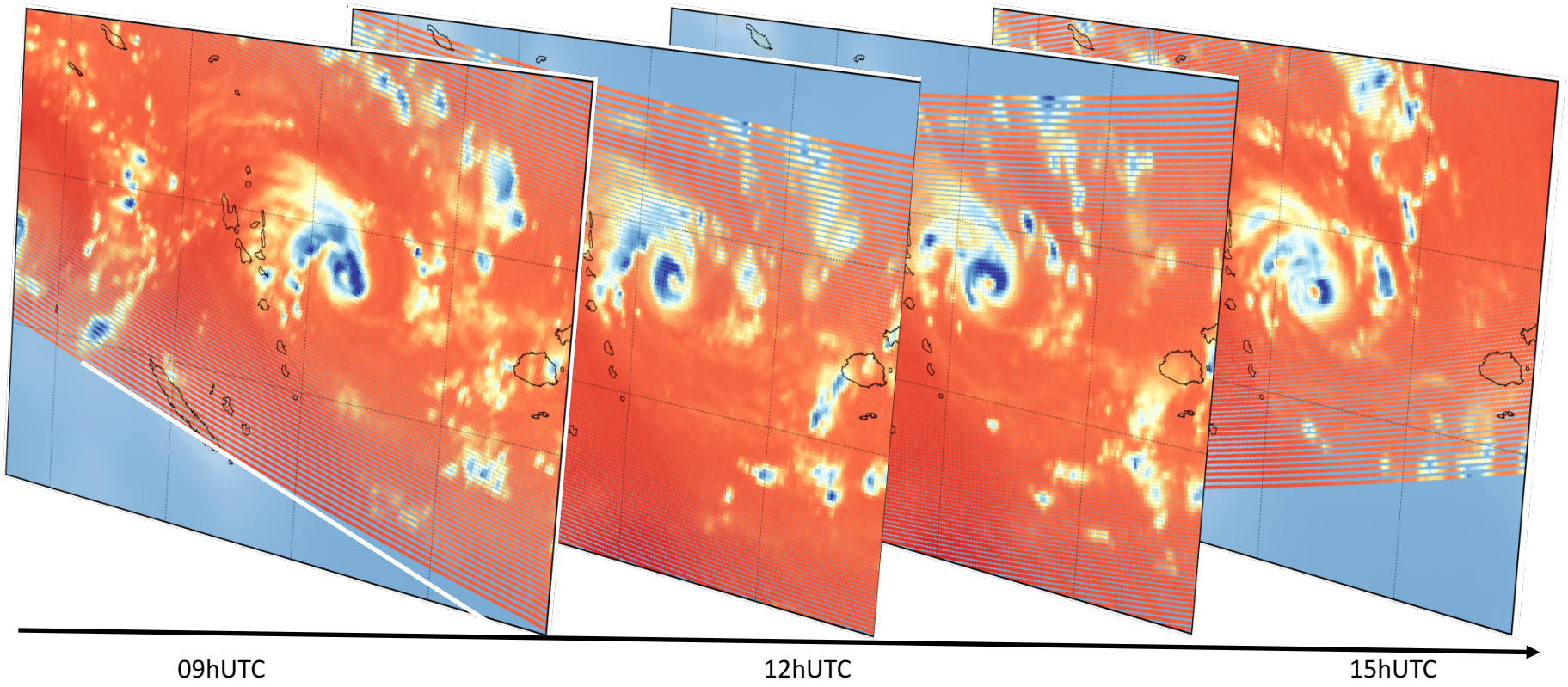
5. Summary

- Both the Megha-Tropiques platform and the SAPHIR and SCARAB instruments are in good health.

- The 2nd extension review process for MT was performed in 2016, a 4 years extension was formally accepted, with a CNES support for new scientific activities.

⇒ sustained CNES funded operations and scientific French activities for the 2017-2020 period

Thank you!



SAPHIR observing Cyclone Winston in Feb. 2016 in a 6h window